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# Neurology<sup>®</sup>

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## Questionnaire-based diagnosis of benign paroxysmal positional vertigo

© Hyo-Jung Kim, Jeong-Mi Song, Liqun Zhong, Xu Yang, © Ji-Soo Kim

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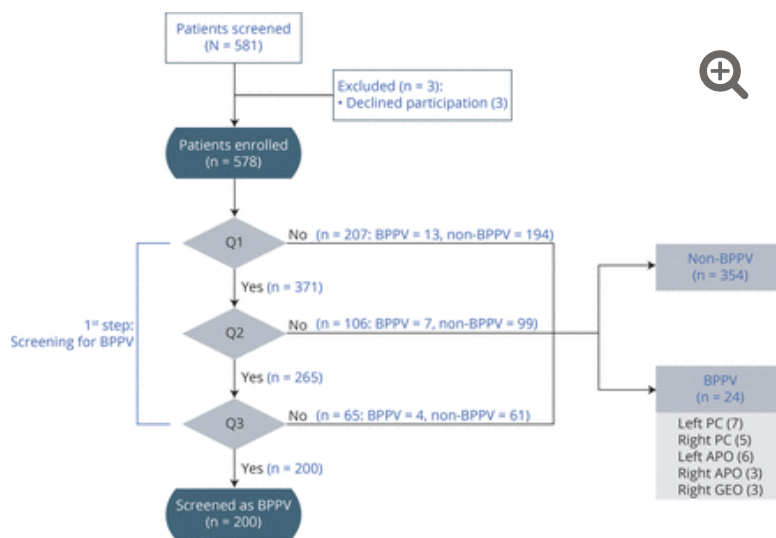
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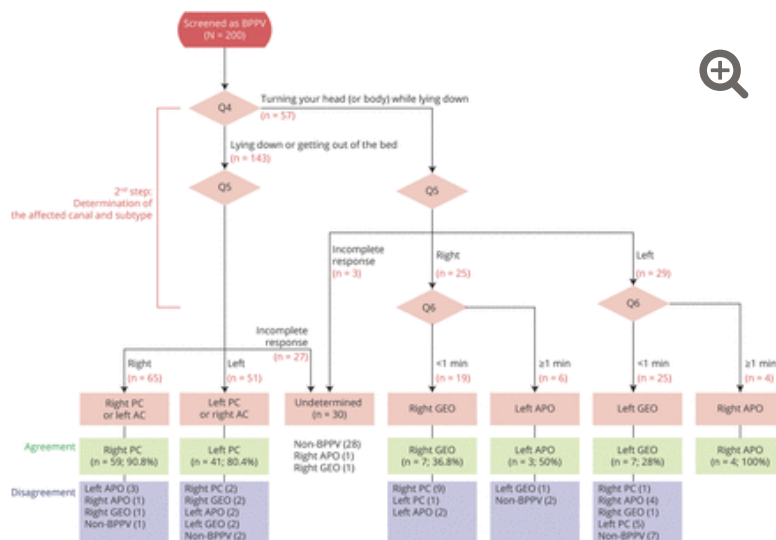
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**Figure 1**

Flowchart for questionnaire-based screening of BPPV

Questions 1 through 3 (Q1–Q3) were designed to exclude patients with dizziness/vertigo due to disorders other than benign paroxysmal positional vertigo (BPPV). APO = apogeotropic horizontal canal; GEO = geotropic horizontal canal; PC = posterior canal.



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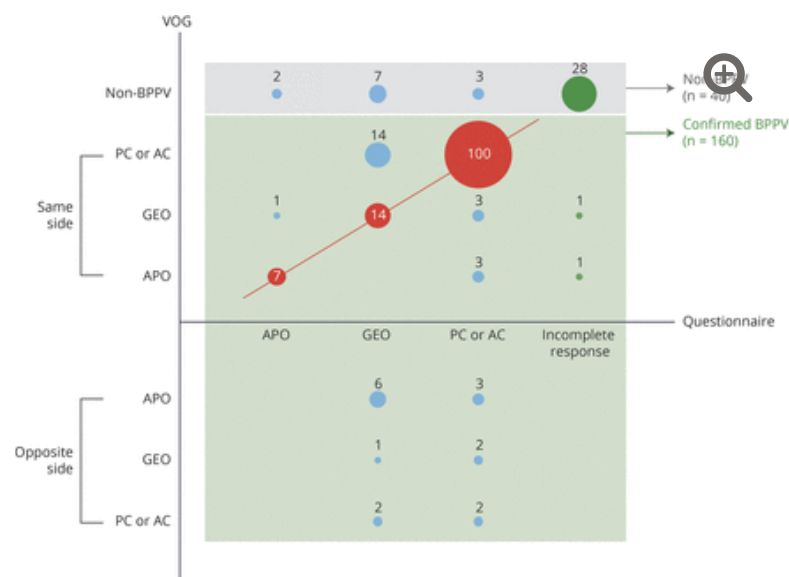
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### Figure 2

Flowchart for questionnaire-based diagnosis of BPPV

Questions 4 through 6 (Q4–Q6) were used to decide the affected canal and subtype of benign paroxysmal positional vertigo (BPPV). AC = anterior canal; APO = apogeotropic horizontal canal; GEO = geotropic horizontal canal; PC = posterior canal.



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### Figure 3

Correct and incorrect predictions of the questionnaire

Among the 170 patients who were able to complete the questionnaire, the questionnaire correctly decided the affected canal and type of benign paroxysmal positional vertigo (BPPV) in 121 (71.2%, red circles) but incorrectly predicted the affected canal or type in 49 (28.8%, blue circles). Of the remaining 30 patients who could not complete the questionnaire (green circles), only 2 had a final diagnosis of BPPV, 1 with geotropic (GEO) type of horizontal canal (HC) BPPV and the other with apogeotropic (APO) type of HC-BPPV. AC = anterior canal; PC = posterior canal; VOG = video-oculography.

## Tables

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**Table 1** Characteristics of patients

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	BPPV (n = 184)	Non-BPPV (n = 394)	p Value	Total
Age, mean ± SD (range), y	64.3 ± 12.8 (33–90)	57.9 ± 15.0 (18–92)	<0.001	60.0 ± 14.7 (18–92)
Sex, n (%)				
Men	52 (28.26)	164 (41.62)	0.0026	216 (37.37)
Women	132 (71.74)	230 (58.38)		362 (62.63)
Affected ear, n (%)				
Right	104 (56.5)			
Left	80 (43.5)			
BPPV type, n (%)				
Posterior	130 (70.7)			
Geotropic horizontal	25 (13.6)			
Apogeotropic horizontal	29 (15.8)			

Abbreviation: BPPV = benign paroxysmal positional vertigo.

**Table 2** English translation of the questionnaire for self-diagnosis of BPPV in Korean

<b>Question 1</b>	Do you have spinning or a whirling sensation of the surroundings or yourself?
<b>Question 2</b>	Do you feel dizzy mostly when your head is moved?
<b>Question 3</b>	Does the dizziness last <3 min?
<b>Question 4</b>	Which positional change makes you feel more dizzy? (1) Lying down or getting out of bed? (2) Turning your head (or body) while lying down?
<b>Question 5</b>	Which makes you more dizzy? (1) Turning your head to the right? (2) Turning your head to the left?
<b>Question 6</b>	How long does the dizziness induced by head turning last? (1) <1 min? (2) >1 min?

Abbreviation: BPPV = benign paroxysmal positional vertigo.

**Table 3** Diagnostic test properties of the questionnaire for self-diagnosis of BPPV

	Accuracy (95% CI), %	Sensitivity (95% CI), %	Specificity (95% CI), %	Positive predictive value, precision (95% CI), %	Negative predictive value (95% CI), %	Positive likelihood ratio (95% CI), %	Negative likelihood ratio (95% CI), %
<b>Question 1</b>	63.1 (59.2–67.0)	92.9 (88.0–96.0)	49.2 (44.2–54.3)	46.1 (41.0–51.3)	93.7 (89.3–96.5)	1.83 (1.65–2.03)	0.14 (0.08–0.24)
<b>Questions 1 + 2</b>	79.1 (75.8–82.4)	89.1 (83.5–93.1)	74.4 (69.7–78.5)	61.9 (55.7–67.7)	93.6 (90.1–96.0)	3.48 (2.92–4.14)	0.15 (0.10–0.22)
<b>Questions 1 + 2 + 3</b>	88.9 (86.3–91.5)	87.0 (81.0–91.3)	89.8 (86.3–92.6)	80.0 (73.6–85.2)	93.7 (90.6–95.8)	8.57 (6.35–11.55)	0.15 (0.10–0.21)
<b>Overall</b>	82.2 (79.1–85.3)	65.8 (58.4–72.5)	89.8 (86.3–92.6)	75.2 (67.6–81.5)	84.9 (81.0–88.1)	6.48 (4.74–8.85)	0.38 (0.31–0.47)

Abbreviations: BPPV = benign paroxysmal positional vertigo; CI = confidence interval.

**Table 4** Comparison between the accurate and inaccurate groups in patients with a final diagnosis of BPPV

Features	Accurate (n = 121)	Inaccurate (n = 63)	<i>p</i> Value
<b>Age, mean ± SD, y</b>	63.9 ± 12.7	65.2 ± 13.0	0.3466
<b>Sex, n (%)</b>			0.0208
<b>Men</b>	27 (77.7)	38 (60.3)	
<b>Women</b>	94 (22.3)	25 (39.7)	
<b>BPPV type, n (%)</b>			<0.001
<b>Posterior</b>	100 (82.6)	30 (47.6)	
<b>Geotropic horizontal</b>	14 (11.6)	11 (17.5)	
<b>Apogeotropic horizontal</b>	7 (5.8)	22 (34.9)	
<b>Involved ear, n (%)</b>			0.7282
<b>Right</b>	70 (57.9)	34 (54.0)	
<b>Left</b>	51 (42.1)	29 (46.0)	
<b>Recurrences, mean ± SD, n</b>	2.8 ± 1.2	2.5 ± 1.1	0.1103
<b>Canalith repositioning procedures, mean ± SD, n</b>	1.5 ± 0.7	1.8 ± 1.0	0.0267

Abbreviation: BPPV = benign paroxysmal positional vertigo.

## Appendix Authors



Name	Location	Role	Contribution
<b>Hyo-Jung Kim, PhD</b>	Seoul National University Bundang Hospital, Seongnam, Korea	Author	Acquired and analyzed the data, drafted the manuscript
<b>Jeong-Mi Song, BSc</b>	Seoul National University Bundang Hospital, Seongnam, Korea	Author	Interpreted the data, made a critical revision of the manuscript

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## Appendix *(continued)*



Name	Location	Role	Contribution
<b>Liquan Zhong, MD</b>	Dongzhimen Hospital Affiliated to Beijing University of Chinese Medicine, China	Author	Interpreted the data, made a critical revision of the manuscript
<b>Xu Yang, MD</b>	Aerospace Center Hospital, Beijing, China	Author	Interpreted the data, made a critical revision of the manuscript
<b>Ji-Soo Kim, MD, PhD</b>	Seoul National University Bundang Hospital, Seongnam, Korea	Author	Conducted the design and conceptualization of the study, interpretation of the data, and revision of the manuscript

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## Disputes & Debates: Rapid online correspondence

### Author response: Questionnaire-based diagnosis of benign paroxysmal positional vertigo

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Submitted December 30, 2019

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Submitted December 30, 2019

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